PREFINAL REPORT

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

FOR

BOILER AND CHILLER PLANTS

AT

FORT MONMOUTH, NEW JERSEY

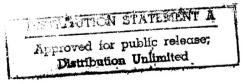
PREPARED FOR
U.S. ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT

UNDER
CONTRACT NO DACA-65-86-C-0101

PREPARED BY
SYSKA & HENNESSY INC. ENGINEERS
11 WEST 42ND STREET
NEW YORK, NEW YORK 10036

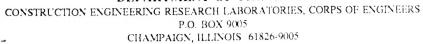
19971016 022

MAY 1988



DTIC QUALITY INSPECTED 1

DEPARTMENT OF THE ARMY



ATTENTION OF:

TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited. Distribution A. Approved for public release.

Marie Wakeffeld, Librarian Engineering

VOLUME I EXECUTIVE SUMMARY TABLE OF CONTENTS

1.0	AUTHORIZATION
2.0	OBJECTIVES OF THE STUDY
3.0	SUBMISSION REQUIREMENTS
4.0	WORK ACCOMPLISHED
5.0	FACILITY DESCRIPTION
6.0	PRESENT ENERGY CONSUMPTIONS
7.0	HISTORICAL ENERGY CONSUMPTIONS
8.0	ENERGY CONSERVATION ANALYSIS
9.0	PROJECTS IDENTIFIED

- I -

VOLUME II NARRATIVE REPORT TABLE OF CONTENTS

Section

EXECUTIVE SUMMARY

- 1.0 INTRODUCTION
 - 1.1 Purpose of Study
 - 1.2 Scope of Work
 - 1.3 Submittals
 - 1.4 Prefinal Report Structure
- 2.0 FACILITY OVERVIEW AND BACKGROUND INFORMATIONS
 - 2.1 General
 - 2.2 Facility Description
 - 2.3 Results of Previous Energy Studies
 - 2.4 Historical Energy Consumption
 - 2.4.1 Electricity
 - 2.4.2 Fuel Oil
 - 2.4.3 Natural Gas
- 3.0 SYSTEM DESCRIPTIONS AND FIELD OBSERVATIONS
 - 3.1 General
 - 3.2 Boiler Plants
 - 3.2.1 Building 205
 - 3.2.2 Building 207
 - 3.2.3 Building 208
 - 3.2.4 Building 270
 - 3.2.5 Building 286
 - 3.2.6 Building 288
 - 3.2.7 Building 291
 - 3.2.8 Building 292
 - 3.2.9 Building 295
 - 3.2.10 Building 500
 - 3.2.11 Building 552
 - 3.2.12 Building 997
 - 3.2.13 Building 1215
 - 3.2.14 Building 1220
 - 3.2.15 Building 2504
 - 3.2.16 Building 2507
 - 3.2.17 Building 2700

- 3.3 Steam and Condensate Distribution Systems
 - 1200 Area Buildings
 - 3.3.2 2700 Area Buildings
- 3.4 Chiller Plants
 - 3.4.1 Building 283 3.4.2 Building 976

 - 3.4.3 Building 1205
 - 3.4.4 Building 1209 3.4.5 Building 1213

 - 3.4.6 Building 1214
 - 3.4.7 Building 2000
 - 3.4.8 Building 2705
- 4.0 ANNUAL ENERGY CONSUMPTIONS
 - 4.1 General
 - 4.2 Fuel Oil Usage
 - 4.2.1 Fuel Oil No. 2
 - 4.2.2 Fuel Oil No. 6
 - 4.3 Electricity Usage
 - 4.4 Natural Gas Usage
- 5.0 ENERGY CONSERVATION OPPORTUNITIES EVALUATED
 - 5.1 General
 - 5.2 Basis for Analysis
 - 5.2.1 PCIP and ECIP Guidance
 - 5.2.2 Basis for Labor and Material Costs
 - 5.2.3 Basis for Energy Cost Savings Benefits
 - 5.3 Boiler Plants, Steam and Condensate Distribution System Energy Conservation Opportunities
 - 5.3.1 Replace Boilers
 - 5.3.2 Replace Burners
 - 5.3.3 Install Oxygen Trim Controls
 - 5.3.4 Reduce Make-Up Water Quantities
 - 5.3.5 Install Blowdown Heat Recovery 5.3.6 Insulate Hot Piping

 - 5.3.7 Provide Summer Boiler
 - 5.3.8 Repair Steam Leaks
 - 5.3.9 Repair Steam Traps
 - 5.3.10 Flue Gas Heat Recovery Equipment
 - 5.3.11 Variable Speed Induced Draft and Forced Draft Fans

- 5.3.12 Air Versus Steam Atomization
- 5.3.13 Combustion Air From Inside Building5.3.14 Convert Steam Turbine to Electric Motors
- 5.3.15 Reduce Hot Water Temperature
- 5.3.16 Reduce Steam Pressure
- 5.3.17 Central Heating Plant
- 5.4 Chiller Plants Energy Conservation Opportunities
 - 5.4.1 Provide Pump Shut-off
 - 5.4.2 Provide Free Cooling Cycle
 - 5.4.3 Install Smaller Compressors
 - Install High Efficiency Motors 5.4.4
 - 5.4.5 Insulate Chilled Water Piping
 - 5.4.6 Install Variable Speed Circulation Pumps
 - 5.4.7 Electric Versus Absorption Chillers
 - 5.4.8 Condenser/Cooling Tower Treatment
 - 5.4.9 Variable Speed Cooling Tower Fan
 - 5.4.10 Storage of Chilled Water
 - 5.4.11 Automatic Condenser and Chiller Tube Cleaners
- 6.0 PROJECTS IDENTIFIED
 - 6.1 General
 - 6.2 Low Cost/No Cost Projects
 - 6.3 QRIP Projects
 - 6.3.1 Project No. 1 - Insulate Hot Piping, Repair Steam Leaks and Steam Traps
 - 6.3.2 Project No. 2 - Install Free Cooling, and Smaller Compressors
 - 6.4 PIF Project
 - 6.4.1 Project No. 3 - Blowdown Heat Recovery and Summer Boiler
 - 6.5 ECIP Project
 - 6.5.1 Project No. 4 - Replace Boilers
- 7.0 OPERATION AND MAINTENANCE PROCEDURES
 - 7.1 General
 - 7.2 Present Practices and Procedures
 - Recommendations

VOLUME III APPENDICES TABLE OF CONTENTS

- A. SCOPE OF WORK, MINUTES OF MEETINGS, CORRESPONDENCE, FIRST INTERIM SUBMITTAL REVIEW COMMENTS, SECOND INTERIM SUBMITTAL REVIEW COMMENTS.
- B. SURVEY NOTES.
- C. ENERGY CONSERVATION OPPORTUNITIES BACKUP CALCULATIONS.
- D. PROJECT DOCUMENTATION BACKUP DATA.

VOLUME IV PROGRAMMING AND IMPLEMENTATION DOCUMENTATION TABLE OF CONTENTS

PROJECT NO. 1: INSULATE HOT PIPING, REPAIR STEAM TRAPS AND

STEAM LEAKS.

PROJECT NO. 2: PROVIDE FREE COOLING, INSTALL SMALLER

COMPRESSORS.

PROJECT NO. 3: BLOWDOWN HEAT RECOVERY AND SUMMER BOILER.

PROJECT NO. 4: REPLACE BOILERS.

1.0 AUTHORIZATION

The Energy Engineering Analysis Program (EEAP) for selected boiler and chiller plants at Fort Monmouth was authorized by the Department of the Army, Corps of Engineers, Norfolk, Virginia, under Contract No. DACA65-86-C-0102 dated September 11, 1986 and subsequent Modification No. P00001 dated April 2, 1987.

2.0 OBJECTIVES OF THE STUDY

The objectives of this study are as follows:

- a. Perform an energy audit of selected boiler and chiller plants.
- b. Review, use and incorporate applicable data and results of related energy conservation studies, past and current.
- c. Perform a site survey to insure that all methods of energy conservation which are practical have been considered.
- d. Identify all Energy Conservation Opportunities (ECOs), including low cost/no cost ECOs, and perform a complete evaluation of each.
- e. Prepare programming documentation for all Energy Conservation Investment Program (ECIP) projects (DD Form 1391, Life Cycle Cost Analysis Summary Sheet with backup calculation and Project Development Brochure (PDB).
- f. Prepare implementation documentation for all justifiable ECOs.
- g. List and prioritize all recommended ECOs.
- h. Prepare a comprehensive report which will document the work accomplished, the results and the recommendations.

3.0 SUBMISSION REQUIREMENTS

As outlined in the contract, included in Volume II, Appendix A, the study is divided into three major submissions:

- a. Interim Submittal
- b. Prefinal Submittal
- c. Final Submittal

4.0 WORK ACCOMPLISHED

Field surveys of boiler plants were carried out during the week of December 1, 1986, field surveys of steam and condensate distribution systems were carried out during the week of April 20, 1987 and the field surveys of chiller plants were performed during the week of July 27, 1987.

During the field surveys, a team of Syska & Hennessy carried out tests, observations, and interviews with Department of Engineering and Housing (DEH), operating and maintenance personnel, and various Building personnel. The operation and maintenance of all the boiler and chiller plants at Fort Monmouth is performed by an outside company under a contract.

Entrance and exit meetings were held with DEH personnel to discuss survey strategy work progress and obtain support information. As decided during the Entrance Meeting, the Interim Report with only Boiler Plants Energy Audit was submitted on June 15, 1987. Subsequently on July 15, 1987 an Interim Report with only Steam and Condensate Distribution System Energy Audit was submitted. Per comments from reviewers these two submittals were combined with the Chiller Plants Energy Audit and the combined Interim Submittal was submitted on November 6, 1987. The Interim Submittal Review Meeting was held in DEH offices at Fort Monmouth on February 10, 1988. The comments of the reviewers and the minutes of the meeting are included in Volume III, Appendix A.

This report consists of four volumes. The first volume is an Executive Summary, second volumes consists of narrative report describing in detail what was accomplished and the results of this study. The third volume includes appendices, detailed calculations and all back-up material. The fourth volume consists of programming and implementation documentation.

A prefinal review conference will be held at Fort Monmouth to review comments on this submittal. The review comments will be incorporated as revised pages, making the Prefinal Report into a Final Report, which will then complete the contract.

5.0 FACILITY DESCRIPTION

Fort Monmouth is a U.S. Army Material Development and Readiness Command (DARCOM) installation located in Monmouth County, New Jersey. The installation is located approximately 45 miles southwest of New York City.

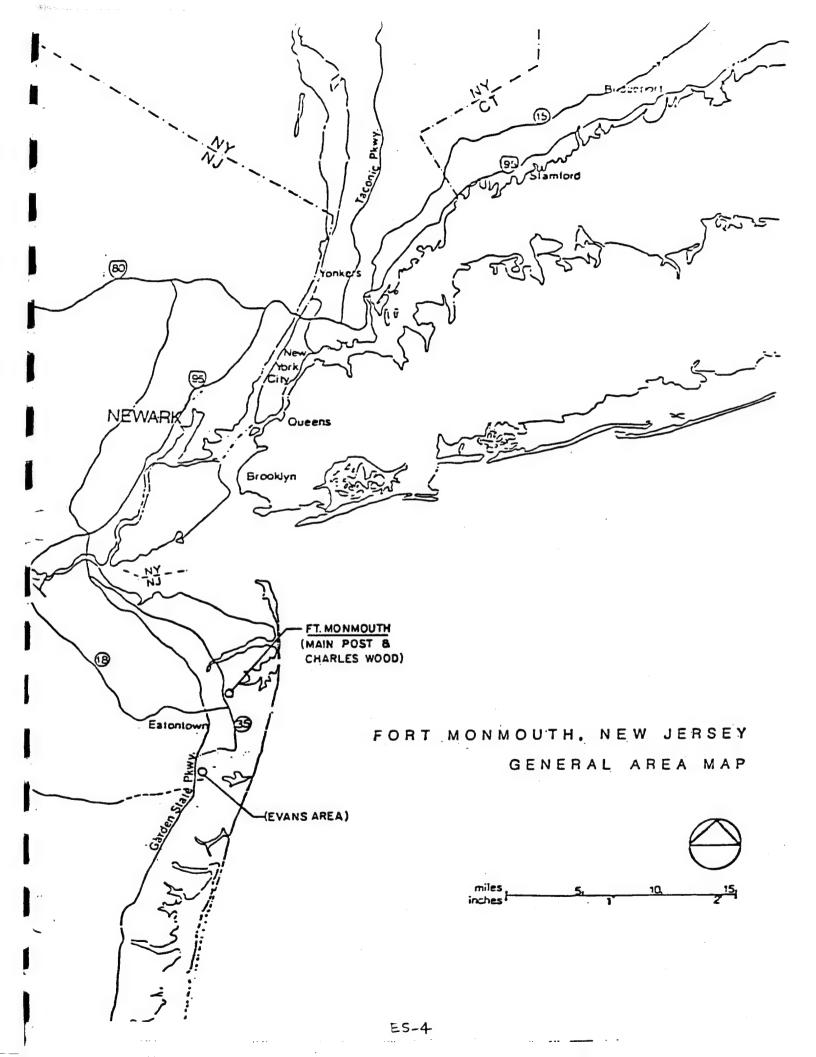
Fort Monmouth provides command, administrative and logistical support for Headquarters, U.S. Army Electronics Command. Seven major activities are located at or near Fort Monmouth; they are: the Army Electronics Command (ECOM), the US Military Academy Preparatory School, the Army Communications Office (TRI-TAC), the Army Satellite Communications Agency, the Army Communications Command Agency, the Health Service Command, Medical Department Activities, and Paterson Army Hospital.

The base consists of three areas: the Main Post, the Charles Wood Area, and the Evans Area.

There are about 610 buildings located on these areas of the base.

Majority of the buildings have dedicated boiler and/or chiller plants.

ES-3 1175N



6.0 PRESENT ENERGY CONSUMPTIONS

Majority of energy consumption at Fort Monmouth is electricity and fuel oil No. 2. Small amounts of natural gas and fuel oil No. 6 are also utilized at the facility.

The electricity used at the facility comes from Jersey Central Power and Light Company via the main substation and post grid of Fort Monmouth.

Ft. Monmouth is subject to billing under service classification GP-General Service Primary. The rate structure as of 12 November 1985 contains the following main provisions:

Customer Charge Per Month: \$125.00

Demand Charge Per kW: \$10.33 June - October

\$ 9.33 November - May

Energy Charge Per kWh: \$0.0709 On-Peak*

\$0.0558 Off-Peak*

Kilovolt-Ampere Charge: \$0.60 per kVa

Energy Adjustment Charge (EAC): All kWh supplied is

subject to Energy Adjustment Clause (Rider EAC). (Average EAC = \$0.0045/KWH).

Fuel Oil No. 2 and No. 6 are purchased from local suppliers and delivered by trucks to boiler plants, fuel oil storage tanks and individual buildings throughout the Main Post, Charleswood Area and Evans Area.

Natural gas for the facility is purchased from New Jersey Natural Gas Company and is distributed through the base by means of government owned gas lines.

^{*}On-peak time, 0800 to 2000 - Monday through Friday. Off-peak time - remaining hours.

HISTORICAL ENERGY CONSUMPTIONS 7.0

The annual energy consumptions* for FY 85, 86 and 87 are shown in the table below.

Year	Fuel Oil No. 2 (Gals)	Fuel Oil No. 6 (Gals)	Natural Gas (Therms)	Electricity (kwh)
1985	1,984,955	781,582	963,367	69,835,602
1986	2,050,100	1,028,800	1,030,508	68,672,737
1987	2,117,383	1,354,214	1,135,712	72,669,763

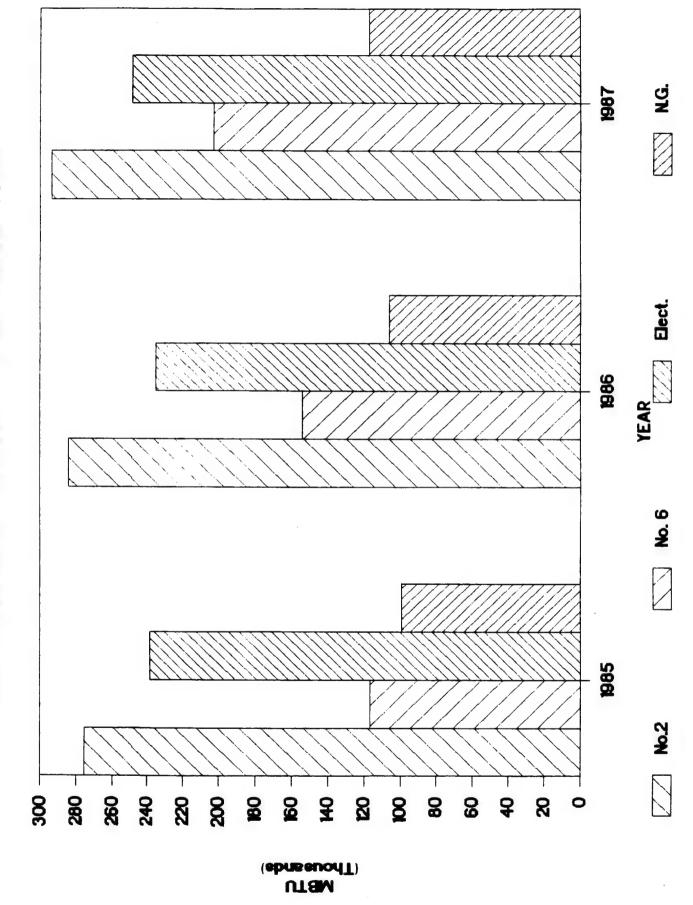
^{*} The energy consumption figures are obtained from DEH.

The energy conversion factors used in the study were as follows:

Electricity: 1 kwh = 3413 Btu

Fuel Oil No. 2: 1 Gallon = 138,700 Btu Fuel Oil No. 6: 1 Gallon = 149,700 Btu Natural Gas: 1 therm = 103,100 Btu

HISTORICAL ENERGY CONSUMPTION



8.0 ENERGY CONSERVATION ANALYSIS

A total of 14 ECOs were evaluated to determine potential energy savings and operating cost savings. Based upon estimated construction costs, life cycle economics were evaluated. The results are summarized in Table 8.1 below. Table 8.2 lists the Prioritized Summary of all ECOs and Table 8.3 lists the Prioritized Summary of recommended ECOs.

ES-8 1175N

Fort Momenth Table 8.1 Summary of Studied Energy Conservation Opportunities (800's)

Name	0	800	SIR	Simple			Y	Annual Savings			Total
Period	. o	Kane		Amorti-	Plante	9.5	0.10	Matural	Total	Cost	
Peplace Boilers				Period	icity	No. 2	Na. 6	Gas	8ner 67		
Replace Boilers 2.67 5.40 17,110 57,491 1,496 11,129.0 55 11,129.0 55 12,20 12				(14)	(tvb)	([4])	(5	(scf)	(MBtu)	=	•
Replace Burners 0.12 68.00 425 59.0 59.0 1		**************************************	7.61	9.5		17,110	57,491	1,496	11,129.0	59,555	684,486
Install Congressors 1.8 1.00 4.25 1.8 1.00 1.8 1.00 1.8 1.00 1.8 1.00 1.8 1.00 1.8 1.00 1.8		Dealers Barners	- 12	68.00	•	425	•	•	9.69	379	13, 297
Tris Controls Reduce Nake-up 0.66 23.40 - 19,150 - 2,867.0 14 Reduce Nake-up 0.66 23.40 - 19,150 - 2,867.0 14 Install Blondows 3.46 4.30 - 4,036 7,580 - 1,266.0 Install Blondows 27.35 0.67 - 4,036 7,357 310 1,692.0 Install Blondows 27.35 0.67 - 56,610 - 8,479.0 Provide Sumer 4.59 3.70 - 2,314 6,865 1,344.0 Repair Steam Leak 27.64 0.66 - 2,314 6,865 1,344.0 Repair Steam Trap 63.18 0.29 - 6,705 18,470 - 3,695.0 Repair Steam Trap 63.18 2.80 9,087 3,695.0 Repair Steam Trap 5.40 81,284 312.3 Install Compressors 5.54 2.30 91,489 312.3 Install Step Effic. 10.12 1.30 2,742	5.3.3	Isstall Oxygen	0.18	43.00	•	425	•		9.65	179	15,030
Reduce Nake-up 0.66 23.40 - 19,130 - 19,130 - 19,130 - 19,130 - 19,130 - 19,130 - 19,130 - 19,26.0 - 19,130 - 19,26.0 - 19		Trie Controls		:		4			0 635 6	11 476	428.189
National Blowdown 3.46 4.90 838 7,680 1,266.0 Install Blowdown 3.46 4.90 - 4,036 7,357 310 1,692.0 Install Blowdown 27.35 0.67 - 4,036 7,357 310 1,692.0 Install Blowdown 27.35 0.67 - 56,610 - 8,479.0 Provide Sumer 4.59 3.70 - 2,314 6,865 - 1,344.0 Repair Steam Leak 27.64 0.66 - 2,314 6,865 - 1,344.0 Repair Steam Trap 63.18 0.29 - 6,705 18,470 - 3,695.0 Repair Steam Trap 63.18 2.80 9,087 3,695.0 Provide Pump 3.68 2.80 9,087 3,695.0 Provide Pump 3.68 2.80 9,087 3,695.0 Provide Pump 3.68 2.30 5,40 81,284 3,77.4 Provide Pump 3.54 2.30 5,42 3,77.4 Install Compressors 5.54 2.30 5,42	5.3.4	Reduce Hake-up	0.6	23.40		19, 150		•	0.10017		
Install Blowdown 3.46 4.30 - 838 7,850 1,550 1		Water Quantities							0 336 1	199 9	16 98
Heat Recovery Heat Resident Heat Residen	5.3.5	Install Blowdown	3.46	3 .	•	97.8	996'	•	0.00717	2	
Insulate Piping 27.35 0.67 - 0.05 1.331 1.331 1.331 1.331 1.331 1.331 1.331 1.341.0 1.341.		Heat Recovery		;				910	1 600 0	111	165
Provide Summer 4.59 3.70 - - 55,610 - 5,475.0 Boiler Boiler 27.64 0.66 - 2,314 6,865 - 1,344.0 Repair Steam Trap 63.18 0.29 - 6,705 18,470 - 3,695.0 1 Provide Pump 3.68 2.80 9,087 - - 31.0 31.0 Shut-off Provide Fump 5.40 81,284 - - 277.4 Cooling Crie 2.30 5.40 81,284 - - 277.4 Install High Effic. 10.12 1.30 2,742 - - - 9.36 Motors Instalte CMM Piping 2.46 5.40 1,638 - - 5.58 5.58 5.58 - - - - 5.58 - - - - - - - - - - - - - - - <	5.3.6	Insulate Piping	27.35	29.0		4,638	100,1	010	0.101		161 671
Boiler Bearin Steam Leak 27.64 0.66 - 2,314 6,865 - 1,344.0 Repair Steam Trap 63.18 0.29 - 6,705 18,470 - 3,695.0 11.04.0 Provide Pump 3.68 2.80 9,087 - - 31.0 Shat-off Provide Pump 2.30 5.40 81,284 - - 277.4 Cooling Cycle Cooling Cycle 5.54 2.30 51,489 - - - 312.3 Install High Effic 10.12 1.30 2,742 - - - - - - 5.56 Install High Effic 10.12 1.30 2,742 - - - - - - 5.56	5.3.7	Provide Susser	4.59	3.70	•		26,610		8,473.0	16,17	
Repair Steam Leak 27.64 0.66 - 2,314 0.803 1,470 Repair Steam Trap 63.18 0.29 - 6,705 18,470 - 3,695.0 11.0 Shut-off 2.80 2.80 9,087 - 31.0 310.0 Shut-off 2.30 5.40 81,284 - 277.4 Cooling Cycle 2.30 5.40 81,284 - 312.3 Install Gomeresors 5.54 2.30 91,489 - 312.3 Install High Effic. 10.12 1.30 2,742 - 35.6 Motors 3.40 1,638 - 35.6 Instalate CMW Piping 2.46 5.40 1,638 - 35.58		Boiler				;			0 446	7 96 6	186 7
Repair Steam Trap 63.18 0.29 - 6,705 18,470 - 3,935.0 Provide Pump 3.68 2.80 9,087 - - 31.0 Shut-off 2.30 5.40 81,284 - - 277.4 Provide Present 5.54 2.30 91,489 - - 312.3 Install Wigh Effic. 10.12 1.30 2,742 - - 9.36 Motors Instals CMW Piping 2.46 5.40 1,638 - 5.58	5.3.8	Repair Steam Leak	27.64	99.0		2,314	0,860	,			631 3
Provide Pump 3.68 2.80 9,087	5.3.9	Repair Steam Trap	63.18	0.29	•	6,705	18,410	•	3,693.0	13,342	196
Shut-off Provide Free 2.30 5.40 81,284 - 277.4 Cooling Cycle Compressors 5.54 2.30 81,489 - 312.3 Install Compressors 5.54 2.30 81,489 - 6.36 Install High Effic. 10.12 1.30 2,742 - 6.36 Notors	5.4.1	Provide Pusp	3.68	2.80	9,087	•	•	•	9.15	2	
Provide Pree 2.30 5.40 81,284 - 211.3 Cooling Cycle 5.54 2.30 91,489 - 312.3 Install Compressors 5.54 2.30 2,742 - 3.36 Motors Motors 2.46 5.40 1,638 - 5.58		Shut-off								036 3	137 66
Cooling Cycle Install Compressors 5.54 2.30 \$1,489 - Install High Effic. 10.12 1.30 2,742 - Notors Instalt CHW Piping 2.46 5.40 1,638 -	5.4.2	Provide Pree	2.30	9.40	81,284	í	•	•	1.117	67 0	7,
Install Compressors 5.54 2.30 \$1,489 Install High Effic. 10.12 1.30 2,742 Hotors Installate CHW Piping 2.46 5.40 1,638		Cooling Cycle								1 145	
Install High Effic. 10.12 1.30 2,742 Notors Notors Instalate CHW Piping 2.46 5.40 1,638 Notors	5.4.3	Install Compressors	5.54	2.30	687'16		•	•	516.4		
Motors Insulate CHW Piping 2.46 5.40 1,638 -	5.4.4	Install High Refic.	10.12	1.30	2,142	•	•		e .	27	
Insulate CHE Piping 2.46 5.40 1,638		Notors							93 3	361	803
	5.4.5	Insulate CHW Piping	2.46	9 .	1,638	•	•		000	3	

Port Momeouth Table 8.2 SIB Prioritized Summery of Studied Bnerfy Conservation Opportunities (800's)

BC0	800	818	Sieple			W	Annual Savings	_		Total
Q	Na se		Amorti-	Blectr-	Fuel Oil	0i1	Matural	Total	Cost	
			Period	icity	160. 2	Fo. 6	8	Sperfy		
			(H)	(PAP)	([8]	([4])	(ccf)	(MBtu)	=	=
	11	81.13	0.29	· · · · · · · · · · · · · · · · · · ·	6.705	18.470	11 11 11 11 11 11 11 11 11 11 11 11 11	3,695.0	19,943	5,157
	Densit Steam Italy	77 64	99.0		2.314	6,865	,	1,344.0	7,254	4,287
9.7.9	feculate Dining	27.35	0.67	•	4.036	1,357	310	1,692.0	9,334	5,594
2	Install High Bffic.	10.12	9.1	2,742		'	•	9.36	210	248
	Hotors							;		
1 1	Install Compressors	5.54	2.30	91,489		,	•	312.3	7,045	15, 157
5.3.7	Provide Sumer	4.59	3.10	•	•	26,610	٠	8,479.0	42,797	151,671
	Soiler							,	;	
5.4.1	Provide Pump	3.68	2.80	9,087		•	•	31.0	100	1,74
	Shut-off									.00
5.3.5	Install Blowdown	3.46	6.4		83	1,680	•	1,256.0	200	100,00
	Beat Recovery						•			
5.3.1	Replace Boilers	2.67	5.40	•	17,110	57,491	1,496	0.821,11	29,333	684,488
5.1.5	Insulate CHW Piping	2.46	9.40	1,638	•	•	•	5.5	971	809
5.4.2	Provide Free	2.30	5.40	81,284	•	•	1	277.4	6,259	32,451
	Cooling Cycle								;	
5.3.4	Reduce Make-up	0.68	23.40	•	19,150	•	٠	2, 167.0	= :	681'82+
5.3.3	Install Orygen	0.18	13.00	•	425	•	•	29.0	212	15,030
	Trim Controls				;					*0 * **
5.3.2	Replace Burners	0.12	68 .00	•	125	•	٠	29.0	2	

		UJ2	SiB	Simple			-Ē	Annual Savings			Towns towns
Period		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		Amorti- zation	Blectr	Fuel	0i1	Matural	Total	Cost	
Repair Steam Trap 63.18 (FWh) (gal) (ccf) (MBLu) (8) Repair Steam Trap 63.18 0.29 6,705 18,470 - 3,685.0 19,943 Install Migh Effic. 27.54 0.66 2,314 6,865 - 1,344.0 7,254 Install Migh Effic. 10.12 1.30 2,742 - 6,865 - 1,344.0 7,254 Hotors 5.54 2.30 91,489 - 56,610 8,479.0 1,045 Provide Sumer 4.59 3.70 - 56,610 - 8,479.0 42,797 Provide Pusp 3.68 2.80 9,087 - 56,610 - 8,479.0 42,797 Shut-off Install Bloudoun 3.46 4.30 - 838 7,680 1,266.0 6,553 Replace Boiler 2.67 5.40 1,638 7,491 1,496 11,129.0 59,555 Replace Boiler 2.30 5.40 1,538 - 1,636 2,555 2,555 Provide 2.30 5.40 1				Period	10117	No. 2	9.0	,	•		
Repair Steam Trap 63.18 0.28 6,705 18,470 1,585.0 19,943 Repair Steam Lak 27.16 0.56 2,314 6,865 1,344.0 7,254 Repair Steam Lak 27.15 0.67 2,742 4,036 7,356 310 1,692.0 9,334 Hotors 1 mstall High Effic. 10.12 1.30 2,742 2.66 3.16 2.10 3.14 3.16 2.10 Provide Sumer 5.54 2.30 91,489 56,610 8,479.0 42,797 1 Provide Sumer 4.59 3.70 - 56,610 8,479.0 42,797 1 Provide Pump 3.68 2.80 9,087 - 56,610 8,479.0 42,797 1 Shut-off Install Bloudoun 3.46 4.90 8.38 7,680 1,266.0 6,553 Replace Boiler 2.46 5.40 1,638 7,491 1,496 11,129.0 5,555 Rowide Free 2.30 <				(i	(#AP)	(128)	(19)	(ccf)	(#Btu)	=	3
Repair Steam Trap 63.18 0.23 2,314 6,865 1,344.0 7,254 Repair Steam Lak 27.64 0.66 2,314 6,865 - 1,344.0 7,254 Insulate Piping 27.35 0.67 - 2,314 6,865 - 1,344.0 7,254 Insulate Piping 27.35 0.67 - 2,314 6,865 - 110 5,334 Hotors 10.12 1.30 2,742 - 6,66 - 7,36 210 Hotors 5.54 2.30 91,489 - 56,610 - 8,479.0 42,797 Provide Sumer 4.59 3.70 - 8,6610 - 8,479.0 42,797 Provide Pupp 3.68 2.80 9,087 - 8,479.0 42,797 Shut-off Install Blondown 3.46 4.30 838 7,680 1,266.0 6,553 Replace Boiler 2.67 5.40 1,638 7,491 1,496 11,129.0 55,555 Replace Boiler 2.46 5.40 1,538 7,491		11 11 11 11 11 11 11 11 11 11 11 11 11	***			306	18 470	11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3,695.0	19,943	5,15
Repair Steam Leak 27.64 0.86 4,036 7,356 310 1,692.0 9,334 Install High Effic. 10.12 1.30 2,742 4,036 7,356 310 1,692.0 9,334 Hotors Install High Effic. 10.12 1.30 2,742 - - - 210 210 -	3.9	Repair Steam Trap	= :	67.0			6 865	•	1.344.0	7,254	1,28
Install High Effic. 10.12 1.30 2.742 1.30 1.489 1.480		Repair Steam Leak	27.64	9.0		116.7	35,6	316	1.692.0	9,334	5,59
Install Big Billo. 17.045 10.00 10.005	3.6	Insulate Piping	21.35	 	2.742	0.0	,	;	9.36	012	72
Install Compressors 5.54 2.30 91,489	Ξ	Install Bigs Bills.	1.1	•	;					970	31 31
Provide Sumer 4.59 3.70 3.087 3.010 700 Boiler Provide Pump 3.68 2.80 9,087 31.0 700 Shut-off Install Bloudoun 3.46 4.90 838 7,680 1,266.0 6,553 Bant Recovery 2.67 5.40 - 17,110 57,491 1,496 11,129.0 59,555 Replace Boiler 2.46 5.40 1,638 - 2,58 126 Provide Free 2.30 5.40 81,284 - 2,77.4 6,259		Install Compressors	5.54	2.30	91,489	•	1 4 6 6	•	8 479 0	12.797	151,671
Boiler 3.68 2.80 9,087		Provide Sumer	(.59	2.2	•		00'00	•			
Provide Pump 3.68 2.80 5.00 5.00 6.553 Shell and all shell Bloadoun 3.46 4.30 5.40 5.40 5.40 17,110 57,491 1,496 11,129.0 59,555 Replace Boilers 2.46 5.40 1,638 2.40 5.58 126 Free Provide Free 2.30 5.40 81,284		Boiler	;	•	600	•	٠	,	31.0	100	1,741
Shut-off Install Bloadown 3.46 4.90 . 838 7,680 . 1,266.0 6,553 Install Bloadown 3.46 4.90 . 838 7,680 . 1,266.0 6,553 Beat Recovery 2.67 5.40 . 1,638 Install CHW Piping 2.46 5.40 1,638 Provide Free 2.30 5.40 81,284 . 217.4 6,259	=	Provide Pusp		01.2	9						
		Shut-off	37 7	06.1	•	838	7,680	•	1,266.0	6,553	30,88
Sepiace Boiless 2.67 5.40 1,638 17,110 51,430 1,430 1,538 126 1,638 1,840 1,638 2.46 5.40 1,638 2.40 81,284 2.30 5.40 81,284	•	Heat Recovery	:			:	•	307	1 199 0	54,555	614.4
Insulate CMW Piping 2.46 5.40 1,638 277.4 6,259 Provide Free 2.30 5.40 81,284	-	Replace Boilers	2.67	9· 1 0	•	17,110	163,16	1,430	25.5	126	809
Provide Free 2.30 5.40 61,504	-	Insulate CHW Piping	2.46	9. S	1,638	•			211.4	6,259	32,4
	7.1	Provide Free	2.30	2·5	187,18	•					

9.0 PROJECTS IDENTIFIED

Based on the guidance from the Division of Engineering and Housing (DEH), Fort Monmouth, economically viable ECOs were grouped into the following projects for purposes of evaluation and preparation of Productivity Capital Investment Program (PCIP) funding documents. The following are the projects identified:

PROJECT NO.	ECO NO.	PROJECT DESCRIPTION
l. (QRIP)	5.3.6 5.3.8 5.3.9	Insulate Hot Piping Repair Steam Leaks Repair Steam Traps
2. (QRIP)	5.4.2 5.4.3	Provide Free Cooling Install Smaller Compressors
3.	5.3.5	Install Blowdown Heat
Recovery (QRIP)	5.3.7	Provide Summer Boiler
4. (ECIP)	5.3.1	Replace Boilers

1175N